



**Safety Iron™**  
Operating and Maintenance Instructions



US Patent No. 7,204,525

## Safety Information

- It is critical that, since most Weir SPM products generate, control or direct pressurized fluids, those who work with these products be thoroughly trained in their proper application and safe handling. It is also critical that these products be used and maintained properly.
- When using this product, safety glasses, gloves, approved safety shoes and hard hats must be worn. Making up or breaking down Safety Iron™ connections may cause foreign material to become airborne.
- Personnel should never tighten or loosen Safety Iron™ connections while the connection is pressurized.
- Always keep all personnel away from flow lines while under pressure.
- It is a personal responsibility to use the proper tools when working with Safety Iron™. Individuals should be knowledgeable and trained in the use of these tools.
- Installation of Safety Iron™ components should be done by persons qualified by Weir SPM to do so. Training is available on a regular basis from Weir SPM. Contact us at 1-800-342-7458 for more information.
- Always be sure to use properly sized and rated components to match the intended purpose and equipment being used.
- Safety Iron™ components are carefully designed and manufactured for their specific application. **Replacing Weir SPM Safety Iron™ components with non-Weir SPM parts can and may result in serious injury or death. Under no circumstances should Weir SPM parts be replaced with those of another manufacturer or vendor.**

### WARNING

FAILURE TO READ, UNDERSTAND AND FOLLOW THE OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

THE USE OF PRESSURIZED COMPONENTS IN OILFIELD OPERATIONS IS INHERENTLY DANGEROUS. PERSONNEL WORKING AROUND ENERGIZED EQUIPMENT AND FLOW LINES SHOULD USE EXTREME CARE AND OBSERVE ALL APPLICABLE SAFETY PRECAUTIONS. PROPER USE OF THIS EQUIPMENT CAN REDUCE BUT NOT ELIMINATE THE RISK OF SEVERE PERSONAL INJURY OR DEATH.

THIS EQUIPMENT SHOULD NOT BE INSTALLED BY ANYONE OTHER THAN PERSONNEL SPECIFICALLY TRAINED IN WEIR SPM PROCEDURES.

## General Information

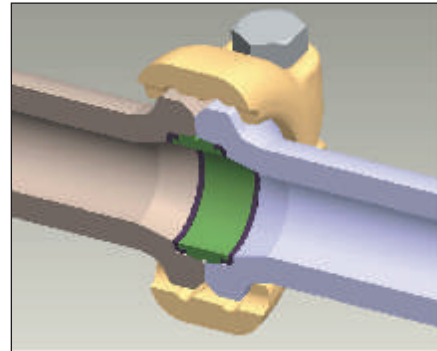
**Note: It is critical that, since most Weir SPM products generate, control or direct pressurized fluids, those who work with these products be thoroughly trained in their proper application and safe handling. It is also critical that these products be used and maintained properly. Worn or broken parts must be replaced with Weir SPM parts only. Failure to replace parts with Weir SPM parts can and may result in serious injury or death.**

### OVERVIEW

Safety Iron™ products are designed as an alternative to the traditional hammer union products used within the oil and gas industry. Safety Iron™ products eliminate the safety hazard of swinging a hammer to make up and break down a connection

while providing stronger, more durable connections that are less fatiguing to assemble for the user.

Available in a broad range of configurations for use in high-pressure applications, these products are built to exact specifications and meet the most rigorous quality standards from third parties such as DNV. Safety Iron™ products are available in 1 1/2", 2", 3", and 4" sizes with pressure ratings up to 20,000 psi.

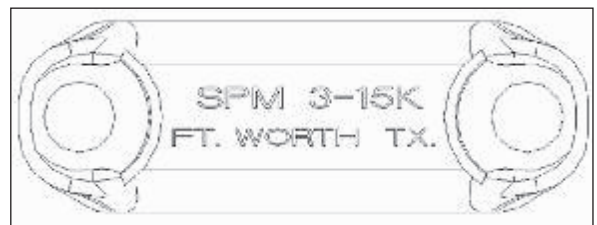


### MAINTENANCE

Safety Iron™ products generally are not maintenance intensive. Care must be taken to ensure that threads on bolts and clamps and all mating surfaces are lubricated, free of burrs, dents, gouges and dirt. Otherwise, products should be maintained as directed. Typical maintenance would include properly cleaning, greasing, or oiling the product after each use.

### IDENTIFICATION

Safety Iron™ products are permanently identified on each individual component. All metal components have full material traceability and are identified by their VENDOR ID (Weir SPM), PART NUMBER, SIZE, PRESSURE RATING, HEAT CODE, and unique SERIAL NUMBER.



### INSPECTION

Safety Iron™ components are generally more robust than their hammer union counterparts. Since no parts are being forced or struck on a regular basis, the parts do not wear very quickly. However, certain features should be inspected prior to use. Also, to ensure safety, qualified personnel should review the overall installation before every use.

- a) Flange faces should be free of significant burrs, gouges, dents, dirt, and cracks. The outer surfaces are precision machined to fit against the clamp inner faces and are an integral part of maintaining a proper seal.
- b) Flange inner sealing surfaces should be clean and free of dirt or debris. Failure to clean these surfaces could cause the connection to leak.
- c) Bolt threads should be clean and free of burrs, gouges, and cracks. Bolts with damaged threads should be replaced immediately.
- d) Clamp threads should be clean and free of burrs, gouges, and cracks. Clamps with damaged threads should be replaced immediately.

- e) Clamp inner mating surfaces should be free of burrs, gouges, dents, dirt, and cracks. Clamps with damaged inner mating surfaces should be replaced immediately.
- f) Soft seals should be inspected for tears or cracks. Seals showing significant wear or damage of any sort should be immediately replaced.
- g) Any part with excessive rust or corrosion that prevents proper assembly or sealing should be immediately replaced.
- h) Parts showing signs of internal washing, corrosion, acid pitting, or rust should be replaced.
- i) Strings, treating lines, and equipment should have an ultrasonic check every six months. See Weir SPM Engineering Specification 1S19644 for minimum wall thickness conditions for specific parts. Weir SPM also recommends routine hydrostatic tests on all Safety Iron™ connections and equipment per Weir SPM Engineering Specification 4S12497.
- j) Weld repair is prohibited for Safety Iron™ products.

## TEMPERATURE RATING

All Safety Iron™ products are rated as low-temperature product. Accordingly, they are certified for the below temperature range:

**Minimum: -30 C**  
**Maximum: 110 C**

For other temperature applications, please contact Weir SPM Engineering.

## **Installation**

### OVERVIEW

Installation of individual Safety Iron™ components and systems should be done by persons qualified by Weir SPM to do so. Training is available on a regular basis. Contact Engineering at 1-800-342-7458 for more information.

Prior to installation, all Safety Iron™ components should be inspected for improper or excessive wear, insufficient lubrication, and general damage. Any damaged part should be immediately withdrawn from use.

In general, Weir SPM suggests that customers adhere to the following principles:

- a) Provided bolts should be clean and lubricated with an approved grease or lubricant. Stripped or worn bolts should be immediately replaced with other Weir SPM-manufactured Safety Iron™ bolts. These bolts are specifically engineered for this application and are not to be replaced with unapproved bolts. Replacement bolts must also have a Weir SPM-manufactured retainer ring installed (once bolt is inserted into a clamp) prior to use in the field. Failure to install the retainer ring or replacing it (or the bolt) with non-Weir SPM parts can lead to serious injury or death.
- b) Provided clamps should be kept clean and lubricated on contact surfaces with an approved grease or lubricant. Bent or worn clamps should be immediately replaced.
- c) All bolted Safety Iron™ connections should be initially made up with an approved power wrench.
- d) All Safety Iron™ connections should be torqued using a Weir SPM "Torque Regulating Bar". This device should be verified by an approved calibrated, manual torque wrench once during each job. This manual torque wrench should be periodically calibrated to ensure accuracy in the field.

**Failure to follow Weir SPM suggestions for equipment, methodology, and verification may result in improper installation of Safety Iron components, possibly resulting in injury and even death.**

## INSTALLATION EQUIPMENT, ACCESSORIES AND SPECIFICATIONS

Through product research and testing, Weir SPM has developed recommendations for the equipment and products that should be used in the assembly and maintenance of Safety Iron™.

- a) **Bolt Lubricant** - Safety Iron™ bolts are heavily loaded under pressure. To extend service life and ease installation, Weir SPM recommends that all bolts be properly lubricated. The following lubricants are recommended by Weir SPM for use on Safety Iron™ bolts:
  - i. Loctite Silver Grade Anti-Seize, part number 76764
  - ii. Loctite Copper Grade Anti-Seize, part number 02910
  - iii. Alternative lubricants can be substituted providing they have characteristics similar to those listed above. It is recommended that alternative lubricants be approved by Weir SPM Engineering prior to use.
- b) **Impact Wrench** - Weir SPM recommends the use of a pneumatic impact wrench for primary assembly of all Safety Iron™. This wrench must be chosen to suit the torque requirements listed below and should have a minimum drive of 1/2". However, a 3/4" drive impact wrench is recommended for the larger Safety (Big) Iron™. If required, an adaptor can be incorporated to allow the use of larger size impact sockets.

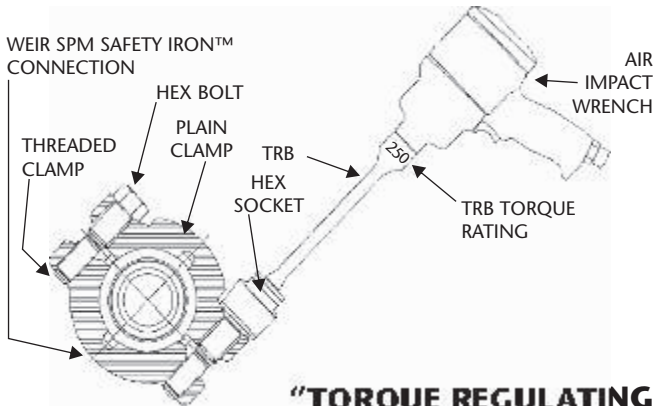
Impact Wrench Specifications			
Safety Iron™ Size	Pressure Rating (psi)	Drive Size (in)	Torque Capacity (ft-lbs)
1-1/2"	15K	1/2	50 to 400
2"	15K / 20K	1/2	50 to 400
3"	15K	3/4	300 to 1000
3"	20K	3/4	300 to 1000
4"	10K	3/4	300 to 1000
4"	15K	3/4	300 to 1000





c) Torque Regulating Bar (TRB) - Safety Iron™ bolts must be properly tightened during assembly to preserve the pressure and structural integrity of the joint. Weir SPM requires that all bolts be torqued such that they fall within 50 ft-lbs of the listed torque for each size of Safety Iron™. This is best achieved by employing the Weir SPM "Torque Regulating Bar".

This device appears like a simple hex drive extension but is actually an engineered product that limits the torque that an impact wrench can impart to a bolt. This functionality is achieved by a specific combination of physical geometry and material properties of the steel. When the torque applied to the bolt reaches the rated value of the extension, the shaft will flex. Before the next impulse from the impact gun can be applied, the shaft will "spring" back. Any further attempts to tighten the bolt will only result in the shaft flexing in sync with the blows from the impact wrench.



**"TORQUE REGULATING BAR FOR ASSEMBLY ONLY. DO NOT USE FOR DIS-ASSEMBLY."**

The extension is easily attached to the impact wrench using a 3/4" square male/female drive with a socket retainer. The additional reach offered by the extension also helps to reduce worker fatigue.

The Torque Regulator Bar is capable of limiting torque to within +/- 25 psi of the rated value and is a function of available air pressure. Due to this, Weir SPM requires that the extension be verified and calibrated before each job (see Calibration Procedure).

Please note that over- or under-torquing the bolts outside of the indicated range is detrimental to the performance and safety of the assembly and may lead to leakage or even failure.

**DO NOT USE TORQUE REGULATION BAR (TRB) TO REMOVE BOLTS - FAILURE MAY OCCUR.**

Safety Iron™ Suggested Bolt Torques		Torque (ft-lbs)		
Safety Iron™ Size	Pressure Rating (psi)	Minimum	Suggested	Maximum
1-1/2"	15K	130	180	230
2"	15K / 20K	130	180	230
3"	15K	200	250	300
3"	20K	360	410	460
4"	10K	200	250	300
4"	15K	480	530	580

d) **Minimum Air Requirements** - In order for the impact wrenches and the TRB to function as intended, minimum air requirements must be met. **Weir SPM recommends 45 SCFM per impact wrench, with an air pressure (measured at the impact wrench) of 90 psi.** Failure to supply these minimum requirements will not allow the wrench to achieve the rated bolt torque, and will increase assembly time due to starvation. In order to minimize pressure drop from the compressor, it is recommended that the minimum hose size be observed. Weir SPM recommends the implementation of a regulator on the air compressor when using multiple impact wrenches to verify proper air requirements are met and not exceeded.

Minimum Air Requirements				
Safety Iron™ Size	Pressure Rating (psi)	Air Supply (SCFM)	Air Pressure (psi)	Minimum Hose Size
1-1/2"	15K	45	90	3/8"
2"	15K / 20K	45	90	1/2"
3"	15K	45	90	1/2"
3"	20K	45	90	1/2"
4"	10K	45	90	1/2"
4"	15K	45	90	3/4"

e) **Manual Torque Wrench** - Weir SPM recommends the use of a manual adjustable torque wrench to verify the calibration of the Torque Regulating Bar. If this extension is not available, the manual torque wrench must be used on each assembled Safety Iron™ connection in order to verify the proper torque.

Each manual torque wrench has a 1/2" drive (or larger) in order to more easily match sockets used for the impact wrench. The following pneumatic torque wrenches are recommended by Weir SPM for use in the assembly of Safety Iron™:

Manual Torque Wrench Specifications			
Safety Iron™ Size	Pressure Rating (psi)	Drive Size (in)	Torque Capacity (ft-lbs)
1-1/2"	15K	1/2	50 to 250
2"	15K / 20K	1/2	50 to 250
3"	15K	1/2 or 3/4	50 to 400+
3"	20K	3/4	100 to 600
4"	10K	1/2 or 3/4	50 to 400+
4"	15K	3/4	100 to 600



f) **Torque Regulating Bar Calibration Procedure** - Due to variations in the operating characteristics of impact wrenches, the torque level achieved by the Torque Regulating Bar should be verified before each job. It is important that a regulator be installed on the compressor to allow for adjustment necessary to complete the calibration procedure.

- a. Adjust the air pressure delivered to the impact wrench so that the tool is operating at 90 - 100 psi at the tool when the trigger is pulled. Note: the regulator may require a higher setting to maintain this pressure.
- b. Using the Torque Regulating Bar on the impact wrench, tighten a clamp bolt until the bar stops turning.
- c. Set a calibrated torque wrench to the maximum bolt torque allowed per the manual.
- d. Check the clamp bolt with the hand torque wrench. The wrench should rotate before clicking is heard. If clicking occurs without rotation, the torque is excessive and the system air pressure must be reduced.
- e. Set a calibrated torque wrench to the minimum bolt torque allowed per the manual.
- f. Check the clamp bolt with the hand torque wrench. The wrench should not rotate before clicking is heard. If rotation occurs before the clicking, the torque is insufficient and the system air pressure must be increased.

g) **Socket Size** - Weir SPM Safety Iron™ comes with specified bolt-hex head sizes. Sockets to tighten these bolts are required to match perfectly. The following sockets should come (at a minimum) with a 1/2" drive:

Bolt Hex Head Sizes		
Safety Iron™ Size	Pressure Rating (psi)	Drive Size (in)
1-1/2"	15K	1-1/2
2"	15K / 20K	1-1/2
3"	15K	1-11/16
3"	20K	2-1/16
4"	10K	1-11/16
4"	15K	2-1/16



## ASSEMBLY OF COMPONENTS

Repeated assembly testing has given Weir SPM the opportunity to determine the safest, fastest, easiest, and most repeatable way to (dis)assemble Safety Iron™. The below instructions detail the suggested steps in properly and successfully making up and breaking down Safety Iron™.

1. Ensure the internal and external surfaces of the Safety Iron™ flanges are clean and lubricated with multi-purpose grease or heavy oil.
2. **Ensure that the seal ring outside surfaces are clean and lubricated with multipurpose grease or heavy oil. This will ease removal at the time of dis-assembly. Insert the seal ring assembly into the bore of one of the Safety Iron™ flanges.**
3. Pull the two Safety Iron™ flange faces together until they are touching each other (or as close as possible). An assembly tool is available from Weir SPM to facilitate drawing large pieces of iron together.
4. Slide the threaded clamp half underneath the Safety Iron™ flanges, pulling it snugly against the flange outer faces. In the interest of eliminating a pinch point, it is best if the clamps are oriented at a 45 degree angle (see right photo). This configuration reduces the chance of a hand getting trapped beneath a clamp or the piping assembly should it be dropped.
5. Set the plain clamp (with captive bolts) on top of the Safety Iron™ flanges, orienting it so that the bolts easily seat against the threaded holes in the threaded clamp.



6. Adjust the clamps as needed to get both bolts to engage easily. Rotate the bolts (by hand) roughly two full turns to guarantee good thread engagement.
7. Attach the Torque Regulating Bar to an approved power wrench. Care must be taken that the bar has the appropriate rating for the intended application. This is clearly indicated on the large end of the extension.

8. Tighten the bolts using an alternating pattern in which the bolts are incrementally rotated. Continue this until the bolts no longer rotate.

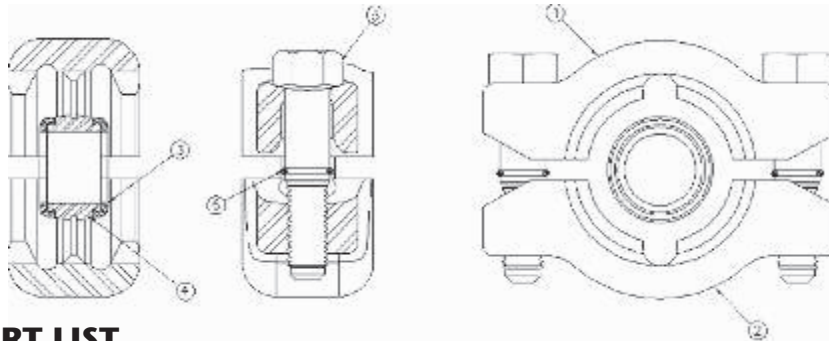


9. Verify that the torque applied to the bolts is within the allowable range for each model. This is to be accomplished by testing the first connection (see Calibration Procedure) using a standard torque wrench. If the Torque Regulating Bar is not available, all connections must have the torque verified.



Upon completing installation, Weir SPM strongly recommends performing a flow line inspection. Verify that all bolts are properly tightened by performing a quick inspection of the line by feeling the underside of each clamp to verify the bolt is within 1/4" of the opening in the bottom threaded clamp. Disassembly of components is roughly the reverse of the above steps. **Do not use Torque Regulating Bar to remove bolts - failure can occur.** Care should be taken to loosen the bolts in a gradual manner. The "two step" method of loosening the bolts is recommended. Loosen one bolt to about its halfway point, then loosen the other the same amount, then loosen the first bolt all the way, followed by the other bolt. Completely disassemble the connection and store the components as desired. It is recommended that clamp halves be bolted together for storage to keep bolt threads from being damaged. Care should also be taken to minimize damage to the metal seal rings by storing them such that they do not come into regular contact (vibration) with other metal surfaces.

## Parts List



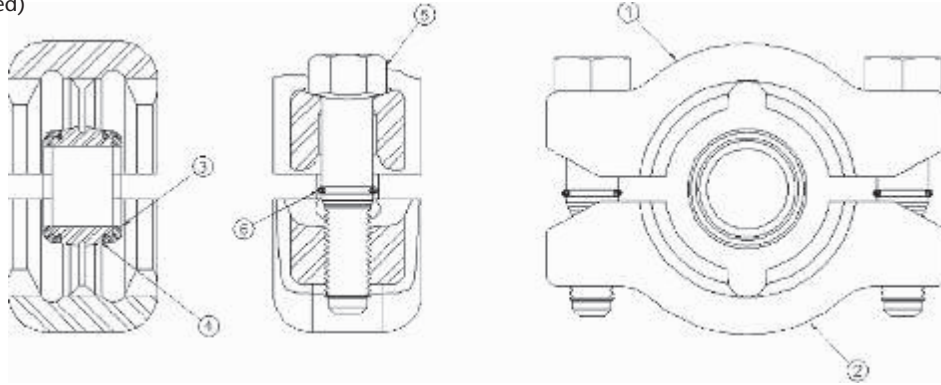
## COMPLETE PART LIST

Parts List		Item					
Size (in)	Pressure (psi)	1-Plain Clamp	2-Threaded Clamp	3-Soft Seal	4-Seal Ring	5-Bolt	6-Bolt Ret. Ring
1.5	15000	2P25912	2P25913	2P25872	2P25781	2P25242	2P25243
2	15000	2P25918	2P25916	2P25250	2P25899	2P25242	2P25243
2	20000	2P25918	2P25916	2P25408	2P26080	2P25242	2P25243
3	15000	2P25904	2P25910	2P25252	2P25903	2P25247	2P25248
3	20000	2P24728	2P25232	2P25252	2P25251	2P25233	2P25234
4	10000	2P25921	2P25922	2P25926	2P25874	2P25247	2P25248
4	15000	2P24728	2P25232	2P24736	2P24735	2P25233	2P25234

## KITS LIST

Complete Kits			Item					
Size (in)	Pressure (psi)	Kit	1	2	3	4	5	6
1.5	15000	<b>2A25930</b>	2P25912	2P25913	2P25872	2P25781	2P25242	2P25243
2	15000	<b>2A25919</b>	2P25918	2P25916	2P25250	2P25899	2P25242	2P25243
2	20000	<b>2A26078</b>	2P25918	2P25916	2P25408	2P26080	2P25242	2P25243
3	15000	<b>2A25917</b>	2P25904	2P25910	2P25252	2P25903	2P25247	2P25248
3	20000	<b>2A25405</b>	2P24728	2P25232	2P25252	2P25251	2P25233	2P25234
4	10000	<b>2A25927</b>	2P25921	2P25922	2P25926	2P25874	2P25247	2P25248
4	15000	<b>2A25402</b>	2P24728	2P25232	2P24736	2P24735	2P25233	2P25234

## PARTS LIST (Continued)



Clamp Only Kits			Item			
Size (in)	Pressure (psi)	Kit	1	2	5	6
1.5	15000	<b>2A25680</b>	2P25912	2P25913	2P25242	2P25243
2	15000	<b>2A25681</b>	2P25918	2P25916	2P25242	2P25243
2	20000	<b>2A25682</b>	2P25918	2P25916	2P25242	2P25243
3	15000	<b>2A25929</b>	2P25904	2P25910	2P25247	2P25248
3	20000	<b>2A26021</b>	2P24728	2P25232	2P25233	2P25234
4	10000	<b>2A26022</b>	2P25921	2P25922	2P25247	2P25248
4	15000	<b>2A25435</b>	2P24728	2P25232	2P25233	2P25234

Seal Kits			Item	
Size (in)	Pressure (psi)	Kit	3	4
1.5	15000	<b>2A25680</b>	2P25872	2P25781
2	15000	<b>2A25681</b>	2P25250	2P25899
2	20000	<b>2A25682</b>	2P25408	2P26080
3	15000	<b>2A25929</b>	2P25252	2P25903
3	20000	<b>2A26021</b>	2P25252	2P25251
4	10000	<b>2A26022</b>	2P25926	2P25874
4	15000	<b>2A25435</b>	2P24736	2P24735

### Torque Regulating Bar (TRB) Part No.

Size (in)	Pressure (psi)	TRB Part No.
1.5	15000	2P26641
2	15000	2P26641
2	20000	CONTACT ENGINEERING
3	15000	2P26642
3	20000	CONTACT ENGINEERING
4	10000	2P26642
4	15000	CONTACT ENGINEERING

## TROUBLESHOOTING GUIDE

SYMPTOM	PROBLEM	SOLUTION
<b>Metal seal ring stuck in bore</b>	Insufficient lubrication in seal area	Insert a screwdriver into the small circumferential groove on the outside diameter of the seal ring. Lever the seal ring out of the bore. Inspect seal ring and seal area for damage or debris. Replace seal ring if damaged. Lubricate seal area prior to reinserting a seal ring.
	Damage to seal ring	
	Improperly cleaned seal area	
<b>Unable to fully tighten Safety Iron™ clamps</b>	Insufficient torque on bolts	Use a calibrated hand torque wrench to verify or adjust torque on the bolts as specified in this manual.
	Improperly aligned clamps	Verify that clamps are properly seated and aligned on the flange faces. Correct if necessary.
	Damaged inner face on clamps	Remove clamps and check inner faces that contact flange. Ensure that no large burrs, gouges, or protrusions are visible. Replace damaged clamp.
	Damaged flange face	Check the flange faces (inner and outer) to ensure that no obvious burrs or protrusions exist. If flange face is damaged, replace part as required.
	Damaged threads on bolts or threaded clamp	Improper tightening of a bolt into a threaded clamp may ruin the thread on the bolt and/or the clamp. Cross-threaded bolts and clamps will have to be replaced. Threads with minor damage can be repaired with a tap and die.
	Insufficient lubrication on bolts	Loosen bolts, then lubricate with approved lubricant.

<b>SYMPTOM</b>	<b>PROBLEM</b>	<b>SOLUTION</b>
<b>Standard impact socket does not fit on Safety Iron™ bolt hex head</b>	Improper clamp alignment	If the clamps are not roughly parallel to each other, the bolt head will be cocked, which may cause the impact socket to interfere with the surface of the clamp. Make sure clamps are aligned properly. All clamps have proper clearances to allow standard impact sockets to fit.
	Damaged hex head	Due to rough treatment, the heads on older bolts may become worn or deformed. Check the hex head on the bolt to ensure that it is clear of obvious protrusions. Replace bolt as needed.
	Incorrect impact socket size	Ensure that you are using the proper impact socket size for the particular size of Safety Iron.
<b>Warped Safety Iron™ clamps</b>	Excessive overpressure	Excessive overpressure may warp Safety Iron™ clamps. Replace clamps, bolts, seal ring, and seals immediately.
	Repeated misalignment	Continued tightening of misaligned Safety Iron™ clamps may warp them. Replace clamps and bolts immediately.
<b>Warped Safety Iron™ bolts</b>	Excessive overpressure	Excessive overpressure may warp Safety Iron™ bolts. Replace bolts (and all other parts) immediately.
	Excessive overtightening	Excessive torque on Safety Iron™ bolts may warp them. Replace bolts and clamps immediately.
<b>Warped seal ring</b>	Excessive overpressure	Excessive overpressure may warp a metal seal ring. Replace seal ring (and all other parts) immediately.
	Heavily impacted by large object	Dropping heavy piping or flow iron on these seal rings may damage a metal seal ring. Replace immediately.
<b>Safety Iron™ bolts not captive in clamp</b>	Retainer ring has been removed	Install new retainer ring on bolt.
<b>Safety Iron™ connection leaking</b>	Improperly torqued bolts	Use a calibrated hand torque wrench to verify or adjust torque on the bolts as specified in this manual.
	Clamp misalignment	Verify that clamps are properly seated and aligned on the flange faces. Correct if necessary.
	Damaged soft seal	Inspect soft seals to verify that they are free from cuts, extrusions, or any other damage. Replace as needed.
	Damaged metal seal ring	Inspect metal seal ring to verify that there are no obvious protrusions or burrs. Ensure all exterior surfaces are free of heavy debris.
	Improper lubrication	Inspect bolts and seal area to ensure that they are properly lubricated. Lubricate if needed.
	Debris in seal area	Inspect seal area to ensure that it is free from heavy residue or debris. Clean as needed.

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